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THE HYGIENE OF MEDICAL CASES, PARTICULARLY IN HOSPITAL WARDS;

WITH NOTES ON VARIOUS WARD INFECTIONS, AND OBSERVATIONS RELATING TO THE PROBABLE ROLE OF SECONDARY GASTRO-INTESTINAL INFECTIONS IN TYPHOID FEVER.[1]

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In the course of the last five years I have been much interested in watching for evidence of the transmission of infections of various kinds in medical wards; and during the latter half of this time I have been especially interested in the question of prevention, for I have become increasingly convinced that infections occur in medical wards much more commonly than I had suspected, and more commonly, I am sure, than the publicly and privately expressed views of physicians, so far as I am acquainted with them, would indicate.

In considering the circumstances in hospitals with which I am connected, and in others that I have visited, it has seemed to me that the system used in regard to the infectious diseases received in medical wards is usually much looser and less comprehensive than is that used in surgical wards; and that the customs in medical wards should be made to approach more closely to those used in surgical wards. In most of the governing principles, except in regard to the channel of entrance of the infection, the problem is much the same.

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[1] Read in part at the meeting of the Association of American Physicians, Washington. D. C., May 7, 8, and 9, 1907.

It is entirely natural that, when once the beneficence of the aseptic care of surgical conditions had become apparent, there should have been a rapid and enthusiastic progress in improving the methods used for the protection of surgical cases; and that the purpose in view should have at once become the prevention of the conveyance of any infection to any patient, and particularly, in surgical wards, the prevention of the transmission of infection from any patient to another, so far as these purposes could be accomplished through the use of any reasonable measures. It is equally natural that there should have been a feeling that medical infections constitute an entirely different order of things, and cannot be approached in the same way; for different and much more complex circumstances are met with in dealing with them. It is likewise natural that much less attention should have been devoted to the prevention of medical infections, for they are essentially less important than the surgical, because less frequent; but the very fact that they are less frequent has led to an insufficient and a slower appreciation of their actual importance, and to their being less vigorously combated. The surgeon so regularly gets bad results, if his methods are bad, that it has been comparatively easy for him to see his errors and to correct them. The physician gets bad results so irregularly, or infections appear clinically so long after exposure, that their real importance and their sources do not readily become apparent, and bad methods may easily be considered satisfactory.

In recent years there has been such a rapid accumulation of testimony regarding the importance of direct transmission of all sorts of infectious diseases from human being to human being by direct or almost direct conveyance, and there has also been such a mass of evidence of the importance, as carriers of disease, of those who come into contact with the sick and afterward convey the causative agents, even though they do not fall ill themselves, that one may justly suspect that in hospital wards, where numerous persons of reduced resistance, many of them suffering from some infection, are brought together, and where those who care for them go from infected to uninfected, there may be much more frequent transmission of infections than we have believed to be the case. There is great difference of opinion as to the actual frequency of such occurrences, and I may have come to consider them more common than they are.

I do not believe, however, that anyone who looks into the matter in the light of modern studies of the transmission of infections will fail to find that what must, for safety's sake, be considered transmission occurs with sufficient frequency to convince him of its serious importance and of the great desirability of making more comprehensive provision against it than is now done.

To this latter statement I think all those who have already interested themselves in this question will agree. What I have to say refers chiefly to those infections that have until recently been classed as non-contagious or, at most, very slightly contagious. Highly contagious diseases are, of course, subjected to very strict rules. For many years also there have been routine regulations in all well-conducted medical wards regarding some of the most important of the other specific infections. These regulations have especially related to tuberculosis and typhoid fever; to a less extent, to pneumonia; still less, to some other common infections; to some of them, not at all.

FAULTS IN CUSTOMARY METHODS. The regulations ordinarily used may, however, reasonably be considered to be inadequate in at least two ways: First, they refer to only a few of the infections that are frequently received in medical wards; not to all of them. This, again, is quite natural, for diseases of this group were once thought to be rarely, if ever, transmitted directly. We have learned only one by one that many of these may be transmitted; and, as this was demonstrated with the most important diseases, regulations were applied to them. At the present time, however, we may safely say that any infection may be transmitted in a hospital ward if conditions favoring its transmission are present; and I think that anyone who observes the conditions in hospital wards must admit that, for most of these common infections, conditions that at least render their transmission more or less readily possible are often present. Considering the knowledge that we now have, it appears to me that the purpose of regulations in medical wards should be the same as in surgical wards; they should aim to prevent transmission of all infections, so far as this is feasible. This is a much more difficult undertaking than is the proper management of surgical wards, and is much less likely to be generally successful; but it is not to be shrunk from if it is a reasonable proposition.

The second objection to the customary regulations is that they cover only a portion of the means of conveyance, even with those diseases in regard to which especial measures are used; and the means of conveyance that are covered are not always those that are the most important sources of infection to the other patients in the wards.

For example, there are rules regarding the disinfection of the excreta, the bedclothes, and the food utensils of typhoid patients; but there are usually at best only indifferent regulations regarding the hands of the nurses, internes, and visiting physicians who come into contact with both typhoid patients and others. Moreover, the regulations that exist regarding the hands are, as a rule, looked upon as being established chiefly for the protection of the doctors and nurses themselves, rather than of the patients; and they are, therefore, often considered to be more or less voluntary. The excreta, however, even if disposed of without disinfection, are more dangerous to the outside public than to the patients in the wards;

the bedclothes are more dangerous to those in the laundry; and the food utensils, while important, would constitute but a limited source of infection if they were cleansed without actual disinfection; but the hands of the ward staff, especially the nurses, are frequently in contact with the persons, the bedclothes, and the excreta of typhoid patients; and subsequently these same hands are often used to examine or treat the mouths of other patients and to prepare their food. One of the most probable sources of ward infections with typhoid fever is, therefore, ordinarily controlled in a very indifferent manner.

In addition to the reasons that I have given, the regulations in medical wards are very frequently inadequate, because no one in authority knows whether they are carried out or not; and, frequently, neither the visiting staff nor the interne knows exactly what the regulations are or how they are intended to be carried out. Not uncommonly, they are devised by the chief nurse, with at most no more than a hasty approval by the medical staff. This latter point constitutes, perhaps, the most striking evidence that surgeons and physicians look at ward infections from different points of view. The surgeon's system is his chief interest and care. With physicians, however, the system is in frequent instances a matter of comparatively minor interest; and indeed many physicians regard it as being of such slight importance that they do not even know the details of the system used in their wards.

A year ago I had a conversation with a woman whose experience in the conduct of hospitals is unexcelled, in regard to numerous details that have to do with what I may call the aseptic care of medical patients. At the end of the conversation she told me that she had often discussed such matters with surgeons, but had never before done so with a physician. I would at once disclaim any appearance of vanity in mentioning this; I would, on the contrary, adduce it as very direct evidence that, with many others, I had not taken advantage of years of opportunity to go into these matters.

In recent years there has been a much more general interest among physicians than there was before regarding ward infections, as we have more clearly learned the possibility of their occurrence and the frequency with which they can be determined to occur, and some of the details of the hygiene of medical wards have been much improved. It is but just to state that if the matter is inquired into it will be found that the improvements have in many instances been largely due to the initiative of the chief nurses. Physicians have contributed some valuable details, but ordinarily they have offered as the most marked means of advance the more extensive use of isolation; and this measure has been somewhat generally adopted in dealing with pulmonary tuberculosis, and is coming into favor, though not yet frequently used, with typhoid fever.

Isolation an Incomplete Solution. I have the utmost sympathy with the use of isolation in the broadest and most intelligent way possible, and I shall mention the manner in which I constantly attempt to make the best use of it that I can with the means at my command. I feel, however, at the same time, that there is an erroneous tendency to believe that isolation is the most complete and ideal scheme that we can adopt. The use of it largely reduces the chances that those diseases that are isolated will be conveyed to other patients, but it alone will not protect the nurses; and, as I shall indicate, this should be an important part of the system in hospitals. Furthermore, it is a measure that can be applied to very few diseases; and I believe that our first object should be to attempt to devise a system that would reduce the possibilities of the transmission of all infections. In addition to this, even if isolation were possible with all the most important diseases, we should, in carrying it out, collect together groups of patients that, while having the same clinical diagnosis, would by no means be of indifferent influence upon one another. Many of the common infections are frequently complicated by secondary infections; indeed, some of them are in the majority of instances. I believe, for reasons that I shall give, that this is frequently true of typhoid fever, in addition to those diseases in which it is commonly accepted as of importance; and when we consider pneumonia, "influenzal" attacks, tonsillitis, and some other more or less serious common infections, we find that under any of these clinical diagnoses we should, in carrying out isolation, actually be grouping together a number of conditions that bacteriologically are often entirely different diseases. Isolation would, therefore, protect those who are not isolated from those who are; but, unless more detailed precautions were taken, it would not protect those who are grouped together in isolation from acquiring infections from one another. Isolation, then, to my mind, is an extremely important part of a complete system, but it is only a part, and there are numerous details that are not covered by isolation, but that need supervision and regulation.

In order to indicate my reasons for adopting the methods that I now use in my wards, and at the same time to illustrate the character of the regulations that I think desirable, I shall describe briefly some of the experiences that I have had with ward infections. Part of these have already been reported. Most of the observations that I shall especially refer to were made at the Episcopal Hospital, where we have constantly had a large number of cases of infectious diseases in the wards. The conditions there were, as a consequence, peculiarly favorable to observations of this character. The number of instances of transmission of infections that I have been able to observe there is, of course, larger than would be the case in a similar period of time in a hospital in which few such cases are received; but large groups of cases are necessary in order to make evident conditions that would not appear if smaller numbers were under observation. In other ways the conditions in the Episcopal Hospital provide an entirely just comparison with well-conducted hospitals in general; for, in regard to nursing and other circumstances, everything has been quite as satisfactory there as in any of the hospitals with which I am acquainted. Indeed, almost all conditions have been exceptionally satisfactory, beyond the fact that the nurses have, at times, been overworked when unusually large numbers of seriously ill patients were in the wards. I do not think that the infections that I have seen could be attributed to inefficiency or carelessness. On the contrary, they were due, I believe, to errors in the methods customarily used in such wards, and the correction of these errors lies in the power of the medical staff of hospitals, and not with the nurses. I have seen more conditions of this kind recently than I did previously, and more than are usually considered to occur, simply, I believe, because I have carefully and deliberately looked for them recently, not because the conditions were exceptional during this time.

While studying the frequency and importance of ward infections, I have devoted some attention to observing numerous details of the care of patients in various hospitals, and have found it exceedingly easy to discover many ways of greater or less importance in which infections could readily be carried. Indeed, in a few instances, I have found customs that so completely disregarded the most evident opportunities for carrying infection that it would seem that there is sometimes a feeling that medical infections are presided over by a different and more beneficent providence than are the surgical. I have found, for example, in a ward in a well-known hospital, that the duties assigned to one nurse were to disinfect the bedclothes and the excreta, and to prepare the liquid diets.

There are very many ways in which infections may be carried; and, since many different infections are met with, it will be impossible for me to do more than to illustrate the things that seem to me to demand attention first of all, because they constitute the most serious dangers, and to indicate some of the ways in which the danger may be reduced without an unreasonable amount of labor and expense. By giving continued attention to the details of the management of these infections, we can, undoubtedly, learn readily many more things that should be done. The suggestions that I have to make I do not by any means consider perfect or complete. They are in part my own; in part they are used in some other hospitals. Certain types of infections have especially interested me; and they will serve to indicate the chief dangers in medical wards, and also the direction that I feel we should take in attempting to eliminate the most important sources of infection.

The whole matter may most readily be approached by first considering the sources. It is apparent that infections are most likely to occur through the food; through the hands of the doctors and nurses, or other attendants upon the patients; through instruments and food vessels, or other ward utensils, such as bedpans and urinals; or through the atmosphere. There are, I think, a number of very evident ways in which protection against these sources of infection is not provided for by the methods now customarily used, even in the best hospitals.

INFECTION OF THE FOOD. So far as concerns infections, the most important of all foods in hospitals is, of course, milk; and, while much has been written about milk in recent years and some improvement has been made, conditions have actually improved so little that they still, in most institutions, need very earnest attention. In the first place, as to the condition of the milk when received. In hospitals that treat such patients the milk supply for babies and young children has, in many instances, been much improved, though there are still many hospitals that provide for young children milk whose source and hygienic condition are absolutely unknown. The most serious dangers are usually overcome by pasteurization. While this measure has its drawbacks and dangers, it is such a tremendous advance over the use of bad raw milk that it is fairly satisfactory; but it is not comparable to the use in the beginning of a reliable milk, for it is about on a par with simply subjecting soiled dressings from infected surgical cases to a high temperature and then using them with uninfected cases.

With medical cases in more mature subjects the conditions in regard to the milk supply are vastly less satisfactory, and much less has been done to improve them. The conditions in hospitals may, I think, be fairly represented by the following statement: A few hospitals have a supply that is actually known to be good, because it is under the supervision of a medical milk commission, or is regularly supervised by representatives of the hospital, from its source to its delivery. A few have a supply that is complacently called their own, or that is under their own control, but is really very inadequately supervised; and, when actually investigated, the milk is found to be very little, if at all, better than ordinary market milk. The great majority of hospitals, however, obtain their supply simply by contract with a dealer, and they usually know nothing about its sanitary condition when given to the patients, although in a certain number of hospitals more or less frequent bacterial counts are made. If these counts are, as a rule, fairly satisfactory, the milk is considered to be reliable. Unless it is an exceptionally good milk, the counts are frequently found to be temporarily very high, but these high counts are usually passed over as inevitable, and any bad results from the use of the milk are ordinarily not remarked upon. The improvement, therefore, in the character of the milk supply is actually slight; and only a small proportion of hospitals exercise any adequate control over the condition of the milk when it is received, while very few adequately control the hygienic conditions at the dairies and in the course of transportation. These latter matters are much more important than mere bacterial counts. In the first place, a dealer can, by surreptitious pasteurization at a low temperature, keep the bacterial count of a bad milk down to a low point, without its being known that he has done this. While this makes the milk safer if it is well done, it is likely to make it less safe if it is badly done; and often it is badly done. Aside from this, bacterial counts alone are a very imperfect indication of the condition of the milk, for they, at best, indicate only that the total bulk of infection that has reached the milk is small; or, more commonly, they simply indicate that the milk has been kept well cooled. They do not at all satisfactorily indicate how dangerous the infections that are present may be, and they do not demonstrate whether the conditions at the dairy and in the course of transportation are such as to make it improbable that the bacteria producing typhoid fever, tuberculosis, diphtheria, and other specific diseases, as well as the much more common bacteria that produce more or less serious gastro-intestinal disturbances, could gain entrance to the milk in dangerous amounts and are likely to do so with dangerous frequency.

The only ways in which such evil possibilities can in the beginning be reduced to a minimum are, for hospitals: (1) To secure certified milk (and this is usually too expensive, and often impossible because such milk is not available in large quantities); (2) to secure their own dairies, or to have dairies supply them directly, and to have the condition of the milk on delivery controlled by regular temperature records and frequent bacterial counts, and the condition of the dairies controlled by sanitary and veterinary inspection; or (3) to have concerted action taken by medical milk commissions and hospitals, whereby a guaranteed milk that is reasonably sanitary may be supplied to hospitals at a moderately increased cost, the hygienic conditions surrounding its production and delivery being under the continuous supervision of the milk commissions. It is earnestly to be hoped that the latter proposition, which is under consideration by the Association of Medical Milk Commissions, may be adopted. It is the most reliable and the least expensive solution of the question now apparent. Many hospitals would soon be persuaded into acting with the commissions, while others that might be reluctant would be forced into doing so through the general enlightenment that would come from the partial introduction of such a measure. At present, however, this solution of the question is not available; and it will not be widely available for some time, for a number of reasons. One important reason is that, as anyone who has tried to find a suitable dairy for a hospital supply will know, there are now in the neighborhood of most cities very few farmers who could supply milk that would pretty constantly pass as sanitary. Hence the farmers also will have to be led into the movement in large numbers, though this will quickly follow the demand.

I have given this very cursory statement of the situation regarding the milk supply in order to indicate the reasons why, as matters are at present, I have been reluctantly forced to the definite conclusion that, except in those few hospitals in which the supply used is carefully and continuously supervised, and is known to be entirely reliable, all milk that is given to patients that are seriously ill, and especially to patients whose gastro-intestinal tracts need careful management, should be pasteurized, whether the patients be adults or children. I have reached this conclusion reluctantly, because pasteurizing adds trouble in the wards and leads to constipation in the patients, and pasteurized milk often becomes somewhat repulsive to adult patients after a short time. Nevertheless, these are minor objections when compared with the bad results that raw milk may produce.

DANGEROUS RESULTS FROM INFECTED MILK. Some years ago I reported widespread and serious abdominal symptoms in the typhoid patients at the Episcopal Hospital, due to the use of a supposedly good milk, which investigation proved to be actually very bad[2] The abdominal symptoms were reduced from alarming prominence and frequency to an unusual inconspicuousness by merely pasteurizing the milk. Subsequently, the milk supply was changed; and the best supply that appeared to be available, exclusive of the certified milks, which are too expensive to be reasonably used in a large general hospital, was secured by the managers, at an increased expense. Rigid regulations concerning its temperature and bacteriological condition upon delivery, and its care after delivery, were established, and pasteurization was stopped. All trouble with milk appeared to cease for some time; but during my next service, I twice noticed that on one day several typhoid patients developed sharp diarrhœa. Upon inquiry, directly after these occurrences, I learned that Dr. Ghriskey had each time found that the milk yielded high bacterial counts on these days. The counts at other times had run very low. These conditions were transitory; but in December, 1905, diarrhœa developed practically coincidently in a number of typhoid patients in the men's and women's wards; and Dr. Miller and Dr. Stevens, who were then on duty, had the milk pasteurized again, because they got reports for several days from Dr. Ghriskey that the bacterial counts were continually running high. Upon investigation, it was found that the refrigerating plant of the man that supplied the milk was out of order. This had evidently caused the trouble, for high counts continued until the plant was reconstructed. This last-mentioned incident appeared to have serious results, for, as will be shown in the table that I shall give later, there were an unusual number of perforations among the typhoid cases at this time and shortly afterward and serious diarrhœa was, as I have stated, very prevalent.

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[2] New York Medical Journal, March 25 and April 1, 1905.

These experiences make it clear that, in spite of the fact that our milk supply is better than that of most well-managed hospitals, we are at any time liable, and most hospitals are still more liable, to unexpected trouble, which may have very bad results; and this may be due to either the misfortunes or the carelessness of those that produce and deliver the milk. Indeed, everyone who has any knowledge of the milk problem knows that all but the most rigidly supervised milks not infrequently show transitory bad infections. Frequent bacterial counts will not prevent trouble. When such counts are high, they indicate that something is wrong; but this is of little importance except in avoiding subsequent trouble, for the final count is obtained only forty-eight hours after the milk arrives, or at best one knows only after twenty-four hours or thereabouts that a dangerous number of bacteria are present, and meanwhile the patients have taken the milk and the damage is done. Such occurrences can be reduced to a minimum, if hospitals and milk commissions can work in unison in controlling the general hygienic conditions surrounding the production and delivery of the milk. Otherwise, it can be done only at an expense that is impossible for most hospitals to undertake. In the absence of either of these safeguards, I believe that pasteurization is the only reliable measure.

The bad results are not confined to typhoid cases. I have notes of four pneumonia cases in which troublesome diarrhœa occurred at the same time that it occurred in the typhoid cases, in the several periods that I have mentioned, in which the milk was known to have been badly infected. I have likewise noted the same thing with patients of various other kinds, particularly with those whose gastro-intestinal tracts were already disturbed or had recently been disturbed.

It is to be especially observed that pasteurization must be properly carried out if it is to make the milk safe. This remark is not so superfluous as it may seem, particularly in managing large groups of cases, when the pasteurization must ordinarily be done in large bulk. I was recently told that the pasteurized milk that they were using in a ward that I visited appeared to be causing gastric and intestinal symptoms. I went over the various steps used there in the process, and finally took the temperature of the air in the compartment of an ice-chest in which the milk was being "cooled." Two hours after the milk had been placed there the thermometer registered 78° F. The ice-chest was entirely unequal to the task imposed upon it. The trouble was overcome by placing tightly covered vessels that contained the pasteurized milk in large receptacles and surrounding them with cracked ice; it was summer time, and the tap-water was too warm to be of service in cooling the milk. It should be known just what all the details of pasteurization are as the process is carried out in each instance. Bacteriological studies by Pennington, Evans, Bergey, and others have sufficiently shown that poor so-called pasteurization may simply make bacteria flourish.

CARE OF THE MILK AFTER DELIVERY. The care of the milk does not cease, however, with the points that I have touched upon. Milk may be good when it gets to the hospital, but very bad when it gets to the patient, and some other foods, especially those that are liquid, may likewise become dangerous in the course of their preparation. In the first place, there should be a definite and suitable system of keeping the milk properly refrigerated after it has been received. I have seen milk, after delivery to a hospital ward, stand for an indefinite time in a warm corridor, because it was nobody's especial duty to look after it and nobody had had a good opportunity to do so.

The system that the managers have established at the Episcopal Hospital follows the proper principles very closely. The milk is received by a graduate nurse, who is required to make an immediate record of the temperature of the milk in each can, and then to have it placed at once in the central cooling-plant, where it is kept at a temperature that is regularly recorded and must be below 45° F. The cooling is done by means of freely iced water. The same nurse is responsible for the expeditious delivery of the milk to the various wards, in the amounts and at the times required. At the wards, it is delivered to an especially designated nurse, who is required to see that it is at once and subsequently kept properly cooled, and that it is protected from infection.

PRECAUTIONS AGAINST INFECTING FOOD IN THE WARD. The latter point is one that is disregarded with surprising frequency. It is, indeed, even more generally disregarded at present than is the condition of the milk on delivery. Everyone is alarmed at once by the knowledge that a person who is coming into daily contact with a case of typhoid fever is working in the dairy from which a milk supply comes; but there is certainly no common concern over the fact that in a very large proportion of hospital wards the general milk supply of the ward is being constantly drawn upon by nurses who at various times soil their hands to a more or less dangerous degree through caring for the mouths, the persons, the excretions, and the bedclothes of patients with typhoid fever, pneumonia, tuberculosis, and a variety of other infections. I have, indeed, mentioned an instance in which a nurse actually had assigned to her as her chief duties the preparation of liquid diets and the disinfection of excreta and bedclothes.

At the Episcopal Hospital we have for some years had one nurse assigned to the sole duty of preparing and delivering to the patients (but not administering) the liquid diets in the medical wards; and this is the ideal system. The enormous importance of infection of the food by nurses who care for the bodies and the various wants of patients has been sufficiently demonstrated by the work of Heubner and other pediatrists, and these observers have, likewise, demonstrated the wonderfully gratifying results that may be obtained by eliminating this danger. The system mentioned has been feasible at the Episcopal Hospital, because we have had there such large numbers of acutely ill patients that the diet-nurse's time was entirely occupied in this way. In any ward, however, it is possible, and is important, that one nurse alone should handle the ward milk supply and any other general supply of food that is not to be cooked subsequently; and the duties of this nurse should not include the care of the persons, the excreta, or the bedclothes of any infectious case, or the handling of any objects that may have been contaminated by such cases.

REGULATION OF THE WORKING PERSONNEL OF THE WARD. Next to the care of the food, the point that appears to me to be of first importance is to establish a system that will reduce the chances that the working personnel of the ward—the doctors and nurses especially, and most particularly the nurses—will convey disease from one patient to another. It is, of course, probable that the mouth is the most important avenue through which infections, when conveyed by them, enter; and in treating patients who are seriously ill, the possibilities, with the system ordinarily used, of conveying infections into their mouths must arrest attention at once. A part of the nurse's duties in such cases is to cleanse the mouth of each patient under her care thoroughly and frequently, and in doing this she may easily carry infection into the mouth; for very commonly she is caring for the mouths, the persons, the bedclothes, and perhaps the excreta, of patients who have non-infectious conditions as well as of those who have infections. She, therefore, has a fruitful opportunity to infect those who are not already infected, and to communicate new infections to those who already have some form of infection. Even when caring for several patients who have the same disease, she may transmit secondary infections existing in one patient to others who previously did not have them. This point has particularly impressed me, both because of the evident opportunities for carrying infection in this way and because it has appeared to me to be the most probable source of some of the ward infections that I have seen.

CARE OF THE PATIENTS' MOUTHS. I have adopted the following system in endeavoring to eliminate trouble from this source:

If she is about to care for patients' mouths, the nurse, before beginning such work, sterilizes her hands, as they are considered to be constantly infected. Indeed, because satisfactory sterilization is difficult to accomplish and would often not be reached, I prefer that she should wear rubber gloves while preparing swabs for the mouth, and also while cleansing the patients' mouths. Before starting to attend to these patients, she prepares, at one time, a sufficient number of applicators wrapped with cotton to make at least two for each patient whose mouth she is to treat. The applicators should be boiled before being used; they are best made of metal, and should be fairly heavy, so that they do not bend easily while in use. The most satisfactory scheme, when such a nurse is available, is to have the diet-nurse, or some other whose duties are such that she does not get her hands infected, wrap the applicators for all the nurses. In cleansing the mouths, the nurse uses one applicator to lift aside the lips, cheeks, etc., and the other, to cleanse with. She avoids touching the lips or the interior of the mouth, or, if she must do so, she at once cleanses her hands again afterward. The soiled applicators are put into a separate receptacle as they are used, and the next patient is then attended to, the whole group needing attention at one time being cared for consecutively. The nurse then removes the cotton from the applicators by means of hemostats, keeping her fingers away from the soiled cotton or metal. In this way, she can, with one sterilization, get her hands clean, and avoid soiling them afterward, while repeated sterilizations between patients would be practically impossible. In case she has at any time to cleanse individual mouths or to make applications to a patient's mouth or throat, her hands should always be sterilized before she begins to wrap the swabs or to treat the mouth, and her fingers should always be kept out of the mouth if possible.

When infectious diseases are present in the wards, and this is nearly always, the same care in treatment as that given an uninfected wound should regularly be given the mouths of the patients. This is often not done. Indeed, in a prominent recent book on nursing, the method of wrapping the finger with gauze that is wet with a mouth wash, and then swabbing the mouth with the finger thus wrapped, is still recommended as the best means of cleansing the mouth. This method is effectual, but is probably, from the standpoint of transmitting infection, the most dangerous that can be used, and I had supposed that it had already been finally condemned.

Visiting physicians and internes have not always a due respect for the mouth as an avenue of infection. I can well remember having examined mouths with entire forgetfulness of the fact that I had shortly before seen patients that had typhoid fever, tonsillitis, or pneumonia, for example, and I still frequently see this done. The hands are sometimes washed, sometimes they are not. When they are washed, it is often done more thoroughly after the examination than before, and it would appear, therefore, to be frequently done from a spirit more of estheticism than of asepsis. I now make it a special point to sterilize my hands before and after examining any patient's mouth or throat, if I must bring my hands into contact with the mouth. I would note incidentally that I also regularly wear a gown in making my rounds, partly because of its moral effect, but much more because I wish to protect my clothing from infection.

CARE OF WARD UTENSILS. The measures that I have just suggested will aid in reducing the extent to which the nurses' hands come into contact with infection. Efforts of other kinds should be made to accomplish the same purpose for the protection of both the nurses and the patients. One prominent way in which this may be done is by boiling all ward utensils frequently, and especially directly after they have been used with infectious cases. Bedpans and urinals, in particular, must constitute a frequent source of trouble, as they are ordinarily cared for. Their contents are disinfected and, to some extent, their interiors, but with the interiors the disinfection is usually only imperfect, and the exteriors are scarcely disinfected at all. Bedpans and similar utensils must carry, much of the time, an extremely varied flora, and frequently a dangerous one. Immersion for some time after use in a disinfecting solution is a fairly satisfactory method, but it is more troublesome and less certain than boiling them. For this purpose, I know of no apparatus so simple and requiring so little trouble as that devised by Dr. Charles P. Noble and for some time used by him at the Kensington Hospital for Women. It consists of a box-like metal receptacle, large enough to contain a number of bedpans, with a faucet for the inflow of hot water, an outlet connected with a drain pipe, and a steam coil in the bottom, the latter being connected with the hospital steam pipes. Hot water can be brought to the boiling point in this within a few minutes, and bedpans and other dirty ward utensils, when made of agateware, can with the greatest readiness be boiled in it as desired, with almost no expense after it has been installed. It takes up very little space.

When thus made bacteriologically clean directly after they have been used, such objects, if handled carefully in emptying them, should be very slight sources of infection for the nurses' hands. In addition to this, although I have not yet insisted upon it, I feel that it is wise to have nurses who are in attendance upon patients with typhoid fever, infectious gastro-enteritis, dysentery, and such disorders, wear rubber gloves (these should, of course, be kept for this purpose alone) in cleansing the persons of these patients, in changing the bedclothes, at any rate if the latter are soiled with discharges, and in bathing the patients. This would eliminate most of the ready opportunities for soiling their hands with infectious material.

There would still remain as a conspicuous source of infection of the hands the necessity for rubbing the patients, and this cannot be done comfortably and well except with the bare hand. It would, however, be comparatively easy for nurses to sterilize their hands regularly after rubbing their patients, as this would require only infrequent sterilization, whereas it is impossible for them to sterilize their hands after each bit of treatment of any sort that they give to the patients. If, therefore, they were protected against all the important sources of infection except that which comes from rubbing the patients, it would be feasible to eliminate this source also pretty thoroughly.

Orderlies should be eliminated from the direct care of patients as much as possible. The administration of enemas and similar forms of treatment should be carried out by the nurse. This is the only means by which danger from orderlies can be prevented, so long as it is so generally customary, as it is at present, to employ cheap laborers, who are often degraded persons, in this capacity. Offering higher wages would improve their quality, but it is questionable whether even then men could be secured who could be trusted with any real care of the sick, for the work is essentially repulsive, and the condition of subordination to everyone else in the ward would be too irksome to most persons of intelligence.

Many physicians will think all these regulations extremely burdensome and a good deal of a tempest over small matters, particularly when so distinguished an authority as Curschmann belittles the danger of ward infection with the most important of the diseases that come especially under these regulations—namely, typhoid fever. They are, however, not actually so difficult to carry out as they sound, and, as to the danger, a vast array of literature in recent years has demonstrated beyond all question the frequency of contact infection with typhoid fever, evidence in most massive form having been given by the report of Reed, Vaughan, and Shakespeare in their report upon Typhoid Fever in the Spanish-American War.

Danger of Typhoid Infection of Nurses. As a direct way of determining the importance of the questions under discussion to nurses and patients in medical wards, let us first consider the effects upon the nurses themselves. This will also serve as an index of the extent to which they may become carriers of infection to patients. In the four years 1903 to 1906 inclusive, we had 14 cases of typhoid fever in pupil-nurses at the Episcopal Hospital. The average number of pupil-nurses in the hospital during this period fluctuated closely around 75. There was, therefore, an average of 3.5 cases a year, and the morbidity among the pupil-nurses was, therefore, 4.66 per cent. During the same period, there were reported in Philadelphia 31,467 cases of typhoid fever—an average per annum of 7877 cases. The population of the city during this time was about 1,500,000. The morbidity of this disease among the citizens in general was, therefore, about 0.524 per cent. Consequently, the morbidity among the nurses at the Episcopal Hospital was 8.9 times greater than among the citizens in general.

At the Pennsylvania Hospital, they had, according to figures kindly furnished me by Dr. Scott, 18 cases among the nurses in nine years, or an average of 2 a year. During each year, they had

60 pupil-nurses in the hospital. Therefore, the average morbidity among the nurses was 3.3 per cent., or 6.3 times the morbidity of the average of the citizens of this city.

In Johns Hopkins Hospital (according to figures kindly given me by Dr. Cole from Dr. McCrae's statistics, which have since been published), they had 15 cases in their total series, that is, in a period of fifteen years, or 1 case a year. Dr. Cole could not give me the average number of pupil-nurses, but since the total of all nurses now ranges from 110 to 120, it appears proper to put the average number of pupil-nurses during this time at about 100. This would give a morbidity among the nurses of 1 per cent. The health reports of the city of Baltimore, kindly furnished me by Dr. Bosley, the Health Commissioner, show, during the ten years from 1896 to 1905, inclusive, 7294 cases of typhoid fever, or 729 per annum. The average population of the city during this period was 528,954. Hence the morbidity there among the citizens in general averaged 0.13 per cent. Consequently, the morbidity among the nurses at Johns Hopkins Hospital was 7.7 times greater than among the outside citizens.

Parenthetically, I would say that, while these figures are striking enough in all three instances, they appear to arraign the conditions at the Episcopal Hospital more severely than those at the two other hospitals, but this is due to the fact that we have had so large a number of cases of typhoid fever in the Episcopal Hospital. During the period that we had 14 nurses ill with the disease (that is, in four years), we had 3230 cases of typhoid fever in the hospital; that is, 1 nurse sickened to every 230 cases received. During the nine years in which there were 18 cases at the Pennsylvania Hospital among the nurses, 4467 patients with typhoid fever were received there, or 1 nurse sickened to every 247 cases. During the time that 15 nurses sickened at Johns Hopkins, there were 1500 cases, or 1 nurse to every 100 cases. Hence a proper comparison indicates that the conditions, while unfortunate enough, were not *relatively* bad at the Episcopal Hospital. They are, however, sufficiently disquieting anywhere, when looked at in the way that I have indicated, and this is, I think, the only proper way of viewing them. The mere absolute number of cases in nurses is not at all a direct indication of the real danger of infection, for the absolute number of nurses anywhere is small. The conditions inside a hospital must be compared with those outside in order to gain a proper conception of the actual dangers.

It may fairly be said that even the figures that I have given by no means represent the danger to those nurses who are chiefly exposed (namely, those in the medical wards), for these figures refer to the total number of pupil-nurses in each of the hospitals. If the morbidity were determined among the nurses engaged in medical wards, it would undoubtedly be much higher. I know of the figures for the nurses working in the medical wards at Johns Hopkins only. Eleven of their 15 cases among nurses occurred among those thus engaged. If it be considered that one-third the nurses are engaged in medical wards (and probably there are usually not more than this), the figures then would be 0.73 cases per annum among 33 nurses, or a morbidity of 2.2 per cent., that is, 17 times the average morbidity of Baltimore citizens in general. The figures become still more impressive when one considers that nurses in hospitals, as well as patients, are much better protected from water-infection than are the outside citizens in general. Pupil-nurses are, of course, in that period of life in which typhoid fever especially occurs, and this is of some importance in explaining their high morbidity. It is, however, far from being a sufficient explanation of these figures.

DANGER OF TYPHOID INFECTION OF PATIENTS. Nurses are then evidently to a most unusual degree, liable to contract typhoid fever. It must be granted that the liability comes chiefly through infection of the hands, and it is impossible to escape the conclusion that they may convey the disease, not only to themselves, but to others. However, the danger to others is less than to themselves because the infection becomes somewhat diluted in transit, and still more because nurses always have opportunity to infect their own mouths, while they have occasion to treat the mouths of only a portion of the patients that they are caring for. I would by no means indicate that I believe that all patients that acquire typhoid fever in hospitals get it through the medium of the nurses. There are a number of other important ways in which they may acquire it, and especially by helping about the ward when they are on their feet, but for those that acquire the disease when they are fast in bed, I think that this is an important source of infection. I have notes of 5 cases of ward infection that I saw in patients at the Episcopal Hospital in the period from 1903 to 1906, inclusive. Three of these occurred in persons that had been confined to bed. Their food was practically beyond suspicion as a source of disease, for it was cared for after the manner that I have described. It seems to me that the next most probable source was the treatment of their mouths. They had all been cared for by nurses who were at the same time giving attention to cases of typhoid fever.

It may, nevertheless, be objected that while it is apparent that the points that I have described as desirable regulations are of importance to the nurses, the number of infections that are known to occur in patients is, at most, too small to justify any very burdensome measures of prevention. Known figures, when properly looked at, do not bear this out, however. As I have said, I saw 5 cases in patients in four years at the Episcopal Hospital. My service there yearly is one-sixth of the total medical service, since six physicians are on duty each year. Owing, however, to the time of year that I serve, I see somewhat more than my share of cases of typhoid fever. While I have not the figures for the experience of my colleagues, I feel that it is safe to consider that, all told, as many as 15 patients acquired typhoid fever in the medical wards in these four years. The number of cases in the medical wards averages about 125. Considering the average number of cases of yearly ward infections in patients to have been 3.75, this makes a morbidity of 3 per cent., or 5.7 times the morbidity of the citizens of Philadelphia in general. In Johns Hopkins Hospital, they have less striking figures, having had but 5 cases in the medical wards in fifteen years, and probably no hospital has a better record than this. These small figures do not, however, actually indicate the degree of danger, for with usually about 100 cases in the medical wards, they have a typhoid morbidity among their medical cases of 0.33 per cent., which is about 2.5 times the morbidity of Baltimore citizens in general. As I have already indicated, patients in hospitals are very much better protected against water infection than are persons outside. These figures also are, therefore, for this reason really larger than they seem; and in addition to this, a few cases probably develop after the patients leave the hospitals in which they acquire the disease, and these would somewhat enlarge the figures. The higher morbidity at the Episcopal Hospital is, again, due not to laxity in methods but to the larger number of opportunities for infection there. We have averaged over 800 cases a year in the period of which I am speaking, while at Johns Hopkins they have averaged 100. Putting aside, however, any question of relative morbidity inside and outside hospitals, I think that there is no doubt that any surgeon who for a series of years had had a yearly average of 3.75 instances of serious septicemias among patients and a similar number among nurses, due to conditions in his wards, would take very active measures to prevent other similar occurrences. The number of cases of typhoid fever in hospitals varies, of course, greatly, but the danger from each case in any hospital is, I think, fairly indicated by the figures that I have given for two representative hospitals.

I may be asked, Would not isolation of the typhoid cases give a much simpler and more certain solution of the question than the details suggested? This would largely protect the other patients from typhoid fever, but it would not protect the nurses in attendance upon the typhoid cases, and this is evidently a matter of immediate consequence. Furthermore, the problem is not one that relates to typhoid fever alone. There is certainly some danger that pneumonia, tonsillitis, and a number of other diseases may be carried in this way, and there is especial danger that various more or less nondescript gastro-intestinal infections may be so transmitted.

I shall mention some instances of the transmission of pneumonia later, and I have some reason for thinking that in a portion of these cases the infection was carried in this manner, but the question of gastro-intestinal infections has especially interested me in this connection.

SECONDARY GASTRO-INTESTINAL INFECTIONS IN TYPHOID FEVER PATIENTS. During several years past I have, particularly, become more definitely convinced that secondary gastro-intestinal infections play an important role in typhoid fever, and I strongly suspect that they are at times introduced in the manner that I have indicated. If I am right in this view, the prevention of such occurrences is a matter of lively interest to the typhoid patients themselves, and if the latter were simply isolated from other patients and no other precautions were taken, they would be in danger of acquiring from one another more or less serious secondary gastro-intestinal infections.

The observations that have led me to this latter viewpoint are purely clinical, and are subject to correction as the result of bacteriological investigation. They are, however, so largely supported by the closely analogous conditions that are known to occur frequently in children's hospitals, especially in infant wards, and they appear to me so suggestive in themselves, that I have little hesitation in describing them briefly and in pointing out rather radical suggestions that must occur to one as a consequence. The train of observations was as follows:

The effects of infected milk in the various instances that I have described and the especially bad results in typhoid patients demonstrated convincingly what is *a priori* to be anticipated: namely, that typhoid patients are especially susceptible to secondary gastro-intestinal infections, and if they acquire such secondary infections the abdominal symptoms become much worse and the disease is, of course, made more dangerous. It is clear, therefore, that if occasion is given for them to enter, secondary infections may play an important role in the disease. In the epidemic of milk infections among typhoid cases that I reported, the effect of pasteurizing the milk was, as I noted at that time, such as to change the picture in the wards from one in which abdominal symptoms were alarmingly conspicuous to one in which they were reduced not only to normal frequency but to so inconspicuous a role that physicians visiting the wards with me remarked upon it as being unusual. With from twenty-five to seventy-five cases of typhoid fever in my wards continuously during my services since that time, I have had many periods, lasting for even weeks at a time, when not a single typhoid patient exhibited hemorrhage, perforation, noteworthy distention, or even diarrhœa that was at all severe. The same thing has occurred with my colleagues.

OUTBREAKS OF DIARRHŒA, HEMORRHAGE, AND PERFORATION. These intervals were broken by periods, which were sometimes prolonged, in which we had constantly a number of cases of more or less severe diarrhœa and distention, and in which hemorrhage and perforation occurred repeatedly, and sometimes in very quick succession in a number of cases. Everyone who has seen large numbers of cases of typhoid fever together has observed such waves of alteration in the character of the group of cases, and I had seen it before, but since the milk has been kept under careful supervision, waves of bad symptoms have excited my attention more sharply, because the periods of freedom have been more striking and more prolonged and have therefore given a better contrast.

These changes are usually attributed to the fact that milder cases are being received at one time, more severe at another. No doubt, this does explain part of the circumstances, but as an explanation for the whole, it is merely begging the question, at best, and it is difficult to understand why the character of a simple typhoid infection should vary so quickly and so frequently in the same community. Furthermore, I especially noted that by no means all the cases that developed bad symptoms were of unfavorable character when they came in, but that, on the contrary, many of them first showed these symptoms when they had been in the hospital for some time. I was also struck by the fact that the change in the character of the cases several times occurred very abruptly. In these instances, in a week after the conditions had been so quiet that no anxiety was felt over any except one or two very toxic cases, we would have a group of cases with very marked abdominal symptoms; and in repeated instances there was a quick succession of cases of hemorrhage or perforation.

Two incidents that I saw, within a few weeks of each other, especially impressed me as pointing to an explanation. In the first, a man, aged forty-four years, of robust frame, was admitted on the tenth day of the disease. He was but mildly ill, had been moderately constipated throughout, and had no special symptoms that aroused the slightest anxiety. An enema was given him thirty-six hours after admission, and he had a formed movement afterward, but a few hours later he developed an offensive diarrhœa with tenesmus, and rapidly became distended. These symptoms continued, and on the next day he had a very severe hemorrhage. He died twenty-four hours later, after repeated hemorrhages, his abdomen having meanwhile become enormously distended. In the bed next to him was a man who before admission already had had an offensive diarrhœa and marked distention. Upon inquiry, I found that the same orderly was in attendance upon both, that the orderly had given the first-mentioned patient an enema; that the rectal catheter through which it had been given had not been boiled before it was used; and that the orderly, as is usually the case with these employés, had not cleansed his hands before administering the enema. The nurses were overworked at this time, and it was necessary for the orderlies to give some of the enemas. Strict orders were, however, given after this as to cleanliness, and the nurses were instructed to boil the catheters themselves before they were used.

Six weeks later another man, who had been in the hospital ten days and had been continuously constipated, developed a sharp offensive diarrhœa within a few hours after having received an enema. The diarrhœa was severe for about a week, but had no more distressing results than to make him more seriously ill than he would otherwise have been. I inquired into this incident also, and, to my chagrin, I learned that exactly the same thing had occurred as in the previous case, owing to the illness of the head nurse of the ward and the confusion resulting from this.

These occurrences made me feel increasingly justified in suspecting that typhoid cases may acquire secondary gastro-intestinal infections from sources other than food. The suspicion was further increased by noting that the stools of those patients who developed diarrhœa at about the same time were, in several outbreaks of diarrhœa, of exactly the same gross character, and quite different from what they had been previously, as well as different from the stools that occur in such patients as the result of what appears to be simple difficulty in digestion, namely their stools were, in some of the outbreaks, deep brown, in others green, and they were strikingly offensive.

APPARENT TRANSFERENCE OF ABDOMINAL COMPLICATIONS. In my services during 1905 and 1906 I devoted especial attention to the sequence of events that occurred when abdominal symptoms appeared in a series of cases. The incidents that I found as a consequence, together with a study of the chronological sequence of hemorrhage and perforation in our wards during these and the two preceding years, have led me to the definite conviction that there is sufficient evidence that special causes of abdominal symptoms may be passed from case to case in typhoid fever to justify us in taking measures to prevent this. There is, likewise, evidence enough to make it very desirable that the bacteriological side of the matter be worked out. The latter has, of course, very great technical difficulties associated with it. Dr. Joseph Evans kindly undertook bacteriological studies of the stools in several cases that developed diarrhœa in two of the periods that I shall describe, and contrasted them with stools from patients without diarrhœa that were in the ward at the same time. In the first instance, however, he was, owing to temporary illness, unable to finish the study; and in the second the results were inconclusive.

Clinically, the sequences were as follows: On April 1, 1905, when I went on duty in the men's wards, I found that of 34 patients who were in the active stage of typhoid fever, 12 had decided diarrhœa, and 5 of them had considerable distention. Within a week, perforation occurred in 5 of the 12 patients with diarrhœa, and 1 had a hemorrhage. Only 1 other perforation had occurred since January

1, of the same year, and there had been but 1 hemorrhage in that time. I looked about for the cause of this and, of course, suspected the milk first, because of my previous experiences; but the milk was in excellent condition at that time. On looking further, I found that the records showed that 3 of the 12 patients had come in with offensive diarrhæa; 2 of these 3 had perforated. The other 9 had developed their diarrhœa one after another within ten days after these three had been admitted.

By April 10 the diarrhœa had subsided, and no patients with typhoid fever in the wards were dangerously ill. No further disquieting abdominal symptoms occurred until April 21, when 2 patients were admitted that had severe, offensive diarrhœa. On April 23, one of these men had a severe hemorrhage; and subsequent repeated hemorrhages caused his death two days later. Meanwhile, beginning April 22 and in the period up to April 29, 8 patients that had previously been free of diarrhœa developed it in some degree—from three to ten movements a day, in the various cases; and of these 8, 6 had severe hemorrhages in the period between May 2 and May 10. Three of these latter 6 died of hemorrhage, and a fourth of perforation.

By May 15 everything had become quiet again among the typhoid cases, and, except for several patients who were very toxic and a number who had slight diarrhœa with curds in their stools, but whose trouble quickly subsided after correcting their diet, there was no trouble up to June 9, except an isolated perforation which occurred, June 8, in a man who had not had diarrhœa. From June 9 to June 11, however, 3 patients were admitted who had decided and persistent diarrhœa, and in 1 of them the movements were very offensive; 3 other patients developed decided diarrhœa within the next week, and between June 14 and June 28 there were 5 cases of hemorrhage, 4 of which were fatal; 3 occurred in patients who had decided diarrhœa, 1 in a patient who was having two loose movements daily, and the other in one who had been having one loose spontaneous movement each day.

My service ended on July 31. In the meantime I saw nothing that I could consider to be evidence of gastro-intestinal outbreaks, beyond the fact that in my last week of service several patients developed diarrhœa of mild character, which had no other serious symptoms associated with it except in 1 case in which fatal hemorrhage occurred. Numerous patients had had some diarrhœa at the time they were admitted; but it was not especially offensive or troublesome in any, and in all of them it subsided in a few days under rigid dieting.

On April 1, 1906, I went on duty again, this time in the women's ward. During the next four months there were no perforations; and, except during a period that I shall particularly mention, there were only the following isolated cases of hemorrhage: April 4 (fatal), April 19 (mild), April 27 (slight), June 18 (fatal). Two of the above-mentioned hemorrhage cases had severe and persistent diarrhœa preceding the hemorrhage. Five other cases were admitted, in the course of the service, with a diarrhœa that was persistent in spite of careful diet and treatment. Numerous others had diarrhœa upon admission, which soon subsided. Except, however, for the one special period which I am about to mention, there were no instances of troublesome or complicated diarrhœa that developed after admission.

The exceptional period was from May 23 to May 30. In this time 6 patients that had severe diarrhœa had dangerous hemorrhages; and 5 of them died. Two of them were among the cases that I have mentioned as having had offensive diarrhœa upon admission. A third had had mild diarrhœa and slight hemorrhage before admission, and both diarrhœa and hemorrhage became more severe after admission. The other 3 developed the diarrhœa soon after the admission of those that already had this complication.

Besides the above-mentioned occurrences, after I had discussed some of these events with my colleague, Dr. Elliston Morris, he directed my attention on July 10, 1906, to the fact that he had in his wards at that time 2 cases with very bad diarrhœa, and 5 others with moderately severe diarrhœa, 2 of them having had persistent diarrhœa since admission. In 1 of these 2 it was exceedingly offensive. The other 5 had developed their intestinal disturbance in the ward, after the admission of the last-mentioned patient.

In all the instances that I have mentioned, the nurses that had the care of the patients that came in with diarrhœa also had to do with patients that subsequently developed diarrhœa. The milk was reasonably well excluded as the source of the trouble in all these instances, for during all of them it was either showing very satisfactory bacterial counts or was being pasteurized; and infection of the milk after its arrival in the wards was also pretty well excluded by the fact that the nurse who had charge of it and of its distribution had no other duties that gave opportunity for her to infect it.

In addition to these instances in which I have described the main course of events, I have, in looking over the records of the cases during 1903 and 1904, been able to determine that three of the little groups of hemorrhage and perforation that show in the chart that I shall subsequently present occurred in association with little outbreaks of diarrhœa that, the records state, developed in the wards. In two, at least, of these outbreaks of hemorrhage and perforation the accompanying diarrhœal outbreaks seem, from a study of the records, to have followed the admission of patients who already had severe diarrhœa; but this is so difficult to determine definitely from simply studying records, especially when their number is so very large, that I cannot be sure of the course of events.

The incidents that I actually observed sufficed, however, to make me feel that most probably infections of the intestinal tract were being transmitted through the wards, and that the outbreaks of hemorrhage and perforation were largely consequent upon this. Considering that the food was an improbable source of infection, and that the mouth is the essential portal of entry, it seems to me highly probable that the infection had been introduced through the care of the patients' mouths; for they were bedfast, and unable to infect themselves through contact with other patients.

THE GROUPING OF HEMORRHAGES AND PERFORATIONS. That hemorrhages and perforations have a striking tendency to occur in groups or sequences has been repeatedly noted by writers. It has been especially remarked in relation to perforation. That this tendency is even more striking than is usually recognized, and that it appears to be due to circumstances existing in particular wards, since these accidents occur in groups in individual wards, seems to be pretty plainly indicated by the chart that I have prepared, which exhibits in their chronological sequence the hemorrhages and perforations that occurred in the men's and the women's wards during the years 1903 to 1906, inclusive, and in the first half of 1907. The total number of cases of typhoid fever during this time was 3677. The chart also shows that the great majority of both the complications under discussion occur in patients that have decided diarrhœa; that they are, therefore, closely associated with evident intestinal disturbance that is not an essential part of typhoid fever. In order that the chart might be simple in form, I have arbitrarily classed as having diarrhœa only those cases in which three or more stools were passed in the day. A considerable number of patients, however, had one or two very loose movements daily, and, therefore, really had diarrhœa; and if these cases were recorded as having diarrhœa, the relation of diarrhœa to hemorrhage and perforation would be still more striking. As the chart stands, however, the figures are: Hemorrhage without diarrhœa, 51; hemorrhage with diarrhœa, 136; perforation without diarrhœa, 15; perforation with diarrhœa, 45. It is apparent, likewise, that diarrhœa was much more prevalent in those that had hemorrhage or perforation in groups or sequences than in those that showed these accidents in isolated instances.

I have included in the chart as hemorrhages all cases in which blood was passed in noteworthy quantities. Mere traces of blood, whether occult or macroscopic, are not included. In order that judgment on this point and others might be uniform, I went over the histories of all the cases myself, in preparing this chart, except for about five hundred cases that Dr. Richard Hooker went over for me.

The next point to which I would direct attention in the chart is that there appear to be an enormous number of hemorrhages and perforations in 1905, and even more in 1906. This is, however, simply because the actual number of cases was extremely large.

In these two years we had 2389 cases of typhoid fever in the hospital, and there were 111 cases of hemorrhage. The percentage in which hemorrhage occurred was, therefore, only 4.6, which is only a little more than half of the frequency of this accident as it is given by most writers. The perforations in these two years numbered 36. They occurred, therefore, in 1.5 per cent. of the cases, which also is distinctly below their ordinary incidence. In the two preceding years the percentages were: hemorrhages, 6.1; perforations, 2.1. These are still below the ordinary averages. I note this in order to show that there was no unusual frequency of these accidents, and that, consequently, there were no exceptionally bad conditions in this group of cases or in the circumstances in the wards which would make the things seen in this series of cases unusual and of no value as an explanation of ordinary conditions.

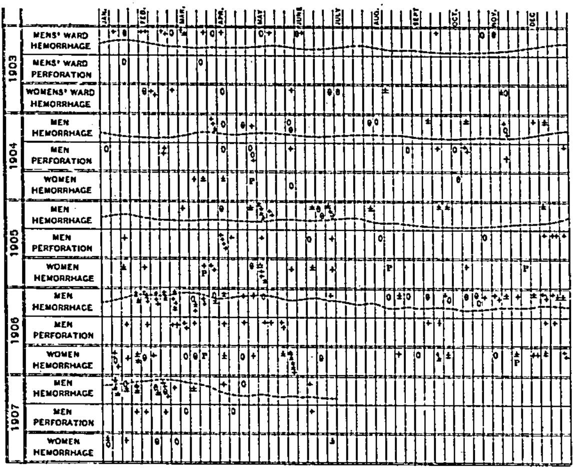

Chart showing the chronological sequence of hemorrhages and perforations in the typhoid fever cases in the men's and the women's wards of the Episcopal Hospital, Philadelphia, from January 1, 1903, to July 1, 1907. The months are divided into fourths (not weeks), in order that the divisions may correspond in the different years. The hemorrhages and perforations in the men are placed in contiguous but separate spaces; the perforations in the women were so few that they are simply indicated by the symbol P in the space for the hemorrhages. The symbol + indicates a non-fatal case with diarrhœa; ±, a fatal case with diarrhœa; 0, a non-fatal case without diarrhœa, and Θ, a fatal case without diarrhœa. Fatalities and recoveries in the cases with perforation are not separately indicated, as most of them were fatal.

Since the hemorrhages were much more numerous than the perforations, they give a much more striking picture. What I have to say refers chiefly, therefore, to the hemorrhages, although it applies almost as well to the perforations also; and, as I have said, the two, as they occurred in each ward, should, in this connection, be considered together.

It is at once noticeable that there are remarkable periods of more or less prolonged freedom from these accidents; then there are times when they occur wholly isolated; but the great majority of them occur near one another in point of time, either in prolonged sequences or in rapid succession in sharply demarcated groups. The groups do not show any tendency to occur coincidently in the two wards. In a few instances they overlap, and in one instance particularly, in May, 1905, striking groups were coincident in the two wards. In the latter outbreak, one might properly think that an especial severity of the group of cases that were being received was the occasion of so many accidents, or that the milk had given rise to the trouble; but the milk was in good condition at this time. Milk was, I think, undoubtedly the chief cause of the trouble, in the early part of 1903, in the men's ward; for it was at this time that the epidemic of milk infection that I have described occurred. The milk was probably, in part at least, responsible also for the succession of perforations seen in December, 1905; but, since the same milk was served in the two wards, it could not well be considered to have been the cause of the trouble in the other numerous groups that were not coincident in the two wards, nor can the trouble be well explained in such instances simply through a supposed difference in the character of the epidemic in the community.

The idea will at once suggest itself that the groupings were due simply to there having been exceptionally large numbers of cases of typhoid fever in the hospital at the time when exceptional numbers of accidents occurred. This, however, I think we may accept at once as being not true. To show this point I have introduced the broken line in the spaces for the hemorrhages in men. That running through the year 1906 and half of 1907 indicates the number of cases in the hospital in each week. In the other years I have introduced a similar line to indicate the number of cases admitted to the house in each month. In these last-mentioned years the weekly records of the number of such cases in the hospital were not preserved. The scale of elevation of this line is fifteen cases to each twelfth part of the vertical space. These lines indicate that there is no regular correspondence between the number of cases in the hospital and the number of abdominal complications. When the latter were very frequent there were naturally in some instances a very large number of typhoid cases in the hospital, but the number was, likewise, very large in some of the periods of prolonged freedom from accident, and the relation between the number of cases and the number of complications is wholly variable.

Considering together, then, the facts that these accidents have a striking tendency to occur in groups or sequences, that they appear to occur in one ward at one time and in another ward at another time; that in most instances they occur in persons that have a disturbance of the bowels that is not an essential part of the disease; and, finally, that in a number of instances I was able to trace what appeared to be a clear relation between the admission into the ward of patients with offensive diarrhœa and the rapid subsequent development of diarrhea in a number of patients that had previously been free from it (these patients repeatedly showing either hemorrhage or perforation in groups), I believe that I had sufficient reason to suspect that secondary gastro-intestinal infections produced many, at least, of the outbreaks of diarrhœa and other complications, and that these secondary infections were passed around the ward.

BEARING OF THESE OBSERVATIONS UPON THE GENERAL CONCEPTION OF TYPHOID FEVER. This raises, of course, the still more radical question whether marked abdominal symptoms of any kind, including hemorrhage and perforation, are not ordinarily due to such secondary infections, more than to the typhoid infection itself. The severity of the abdominal symptoms in typhoid fever would then depend less upon the typhoid infection itself than upon the character of any secondary infections in the bowel. This, again, leads to a consideration of the question whether the ulcerative lesions in the intestine that are so nearly a regular feature of typhoid fever are not due to secondary infections more than to the typhoid infection itself, and whether the extent of the ulceration is not dependent chiefly upon the severity and character of any such secondary infections that may chance to gain entrance to the intestinal tract. I am, of course, not justified in going further than to point out the suggestiveness of the conditions that I have described in relation to these points. A definite conclusion in regard to such matters can be reached only by more exact studies, which must be chiefly bacteriological and subject to great difficulties. I may note, however, that these suggestions are, at least, in consonance with the fact that widespread infiltration of the lymphatic tissues occurs in typhoid fever, especially throughout the abdomen, but that destructive lesions in such tissues occur with very great rarity anywhere except in the intestines. There they occur almost always, and it is just there that varied kinds of bacteria are always present, so that the opportunity for some sort of secondary infection is always present. These suggestions are likewise in consonance with what we have learned regarding a number of other infectious diseases, in which the primary infection so often opens the way to a secondary infection that produces the most serious local lesions.

This question has more than an academic interest. Should the above-mentioned suggestions prove correct, we must still expect that abdominal symptoms and accidents will inevitably occur in a certain number of cases, whatever we may do, for a variety of bacteria are always present in the intestines. But the practical bearing of the matter would be that, with strict precautions as to the food and general care of such patients, it would be possible to save many cases from unnecessary secondary infections, especially from those that are severe and dangerous; and it would thereby be possible to reduce the frequency of abdominal symptoms and complications. Indeed, whatever the relation of secondary infections may be to the ordinary lesions of the disease, I am, as I have stated, convinced through my experience with milk infections in typhoid cases, as well as through these observations which so strongly suggest ward-transmission of secondary gastro-intestinal infections, that the at least occasional occurrence of such infections must be reckoned with, and all reasonable precautions must be taken to prevent their occurrence through the food or the general care of the patients, particularly in hospitals, where there are large numbers of opportunities for the transference of such infections.

Pediatrists have learned through most painful experience, especially with infants, not only that milk is of enormous importance in producing infections of this character, but also that there is grave and constant danger of transmitting these infections from child to child. At present, there is no well-conducted infant's ward in which this danger is not combated by careful regulations. In spite of all care, transmissions occur occasionally; and in many such hospitals it is still customary to discharge infants as soon as they are in a condition that makes this at all safe, for fear that they may acquire such infections. The conditions in regard to adults present no essential difference, except that adult patients are ordinarily much less susceptible to such infections. Those adults, however, who are already more or less profoundly ill can hardly be considered to be vastly more resistant to such infections than are infants; and this is especially true of typhoid patients, whose digestive tracts are very easily disturbed. The conditions that I have described are closely analogous to those that occur in infants' wards. The fact that such conditions occur in infants' wards and the necessity for controlling them have, very properly, been accepted without definitely tracing their occurrence by bacteriological methods. The final evidence of their occurrence in these wards or in adult wards, and particularly the evidence as to the exact nature of these infections, must be given by bacteriological studies, but this evidence is not necessary to make precautions with adults seem reasonable, any more than it is with infants.

It will unquestionably be said by many clinicians that my experiences are at best unusual, and therefore not representative of ordinary conditions. This may be true; but it may, at the same time, fairly be urged that I have especially searched for these conditions, and that I have had a most exceptional opportunity for observing a very large number of cases, and, therefore, for seeing things that would not be apparent in observing smaller groups, even though they occurred. The effect of this latter point is seen in the chart. The groups in 1905 and 1906 are very apparent and extremely striking. In 1905, in the men's ward, 21 accidents occurred in three definite groups; 5 others occurred in rapid sequence in December. Only 8 others, all told, occurred in isolated form during the entire remainder of the year, and 2 of these 8 occurred in close succession. The concentration of accidents in the early part of 1906 and 1907 is even more remarkable. In 1904, however, and especially in 1903, in which years the number of cases was much smaller, the groups are not striking. Nevertheless, looked at in the light of the conditions that were met with in 1905 and 1906, it is evident that there were groups, though smaller ones, in 1903, and especially in 1904. In the latter year, there are five little groups, in each of which 3 or 4 accidents occurred in about a week. The total of accidents in these groups was 20. In the whole remaining portion of the year only 12 accidents occurred, and several of these happened very close to the groups, and may have been really a part of the latter; 6 of them, indeed, occurred in pairs. Such occurrences may sometimes be simply coincidence. They may, however, quite as well be due to the conditions that I have suggested, and coincidence is a poor explanation for things that occur in a large proportion of instances, and is likewise an explanation that accomplishes nothing.

TRANSMISSION OF CAUSES OF OTITIS MEDIA. In addition to the matters that I have discussed, there are certain other types of ward infections, and precautions pertaining to them, to which I would refer. It has repeatedly been noticed in groups of sick children, particularly in those who have diphtheria or one of the acute exanthemata, that otitis media occurs with striking frequency, and this has sometimes been attributed, very properly, I think, to transmission of a special infection of the mouth-cavity among the cases at such times. The same thing occurs at times in adult patients that have various diseases, and, in addition to those diseases in which especial involvement of the nose and throat is a typical part of the disease, it is particularly seen in typhoid fever. In 1902 I had 7 cases of otitis media in typhoid cases in the course of two weeks, and in 1906 Dr. Stevens had among his cases a rapid succession of this complication. It is highly probable that when it occurs in a number of cases in the same ward within a short time, the infection causing it is transmitted from case to case, and it is most probably directly introduced into the mouth. The precautions that I have suggested regarding the treatment of the mouth would serve to reduce the frequency with which such infections also can be carried.

In addition to this, the nurses and doctors should, in treating ears that are already involved, adopt similar precautions with their hands, in order to avoid infecting the hands and thus transmitting the trouble. This applies to the treatment of cases of any kind in which otitis develops. It is, however, especially applicable to the wards of those hospitals which care for highly contagious diseases, such as scarlet fever, diphtheria, and measles, in which this complication is very common. In such hospitals, as in general hospitals, patients with the same disease are very often treated as if they were harmless to one another, while, when they have such complications, they almost certainly are not harmless.

INFECTIONS OF THE SKIN. Infectious skin disorders have, likewise, given me some concern. I reported an experience that I had in 1903, in which a very peculiar vesiculopustular skin infection of considerable severity was evidently transmitted to five cases of typhoid fever in the same ward. It was due to a staphylococcus. On account of the situation in which it began in these cases, I suspected that it was carried by the bedpans or was inoculated by the nurses in rubbing the patients. I instituted precautions, which related especially to the disinfection of the exterior of the bedpans, the bath-tubs, and the gauze sponges used in giving sponge-baths; and I required the nurses to take particular care in sterilizing their hands after treating the persons of patients that had any sort of skin infections. This complication did not develop further in my ward, though the infection still seemed to be about the hospital, for it appeared later in another part of the house.

Previous to this I had twice seen a number of patients in succession develop, within a short period, a more or less extensive furunculosis. Since then, also, when I was not on duty, a man was admitted with a number of bullæ of the skin, which became pustular and then gangrenous. Two other patients, near by, developed the same condition within a few days. All three died. This condition, also, was evidently transmitted. More precautions than are usually taken are needed to prevent similar occurrences.

I have, since I saw the little epidemic in 1903, had the nurses that have charge of cases with any infectious skin lesions, even furunculosis, take especial care regarding the sterilization of their hands after treating them, and I prefer that, when looking after such cases, the nurses should wear rubber gloves that are kept for this purpose alone. This is intended to avoid carrying the infection to the skin of other patients (in rubbing them, etc.), and also to avoid the danger of transferring the bacteria from the skin lesions to the mouths of the same or other patients.

I have, likewise, had the gauze used for sponges boiled after bathing any patients, before it is used for others. That which is used for patients with skin lesions is kept for them alone, and the basins employed for sponging such patients are disinfected carefully after their use. The question of the sponges would seem to be scarcely worth mentioning at the present day, but I know that it is often disregarded. Recently, in a prominent hospital in another city, an extremely old marine sponge was seen being used for a typhoid patient, and, upon inquiry, it was learned that it was used with many patients and it was not known that it had ever been subjected to any more drastic measures than ordinary washing. Marine sponges should not be used, for their supposed advantages are theoretical rather than real, and they cannot be successfully sterilized; and gauze sponges, from mere estheticism, as well as for safety, should be boiled after they are used. The boiling of the bedpans and other ward utensils is important also in relation to skin infections, as well as for the reasons that I have already mentioned.

If such cases as impetigo contagiosa appear in the ward, I isolate them and put a special nurse in charge; and I would do the same should any case such as those that I have described as occurring in little epidemics appear. Since I have taken precautions against such complications, I have had no multiplication of cases of extensive furunculosis and no evidence of the transmission of any other skin infection. These infections are rarely grave, though they occasionally are. They are always, however, distressing and, if severe, exhausting to the patient; they sometimes lead to bedsores, if they are in areas that are exposed to pressure; and there is always slight danger that serious general infection may occur from them.

Not less important than any of the conditions that I have mentioned is the proper care of such cases as pneumonia, tonsillitis, "influenzal" attacks, and, of course, tuberculosis. I think, too, that special attention should be given to dysentery and to any cases of gastro-enteritis or colitis that are apparently due to a sharp infection rather than to dietetic errors. So far as any of these require attention to their mouths (and pneumonia and tonsillitis cases always do), precautions similar to those that I have described should regularly be taken, in order to prevent carrying other infections into their mouths, and, likewise, to prevent transference from them to the mouths of other patients. The precautions against unnecessary soiling of the nurse's hands with excretions of all sorts, which I have described as applying especially to typhoid fever, are of importance in these cases also, and they should be regarded with particular care in dealing with all sputum, and with the stools of cases of gastro-intestinal infections. Drinking cups and other food utensils, thermometers, etc., that are employed with any of these cases should be for their individual use, or should be carefully sterilized after being used. Drinking vessels are best made of agate ware, in order that they may be boiled after they are used. The most important further points regarding the care of patients of the type now under consideration I may most readily mention under the general subject of the isolation or segregation of infectious cases.

ISOLATION AND SEGREGATION. Isolation of those infections which are received in general hospitals is, of course, an exceedingly difficult thing to carry out in a satisfactory manner, both because the present-day hospital plants are, as a rule, so constructed that they do not permit of it, and because it is very costly with any arrangement of the hospital, owing to the increased demands for nurses, the extra time consumed in other ways, and for other reasons. The problem that we have to meet is to make the best possible use of the plants that we now have, and to keep within reasonable bounds as to expense. Anything that we do that is at all effectual will cost somewhat more than methods that disregard this precaution, but physicians are quite as well justified in asserting the rights of their patients as are surgeons, and if they are convinced that their demands are just, they may properly insist with equal earnestness upon the insertion of their demands into the hospital budget. We can, however, with our present hospital plants, do much better than is now usually done, without going to very great expense.

In planning isolation and segregation measures, it appears to me that we should not endeavor to obtain simply the most ideal results possible with one or two particular diseases, but should attempt to cover the whole field of action in a manner that, while perhaps imperfect in relation to an individual disease, is such as to offer the greatest general security against all serious infections. I have, therefore, directed my efforts in a manner that differs somewhat from that which is customary at present among many of those who have urged isolation, especially as regards typhoid fever. The principle upon which I have acted is that at present we have little power, except through isolation or segregation, to prevent the transmission of those diseases which appear to be somewhat commonly transmitted through the atmosphere, or which we must at any rate, for safety's sake, still consider to be commonly transmitted in this way. We are in the same position with regard to those diseases which can be transmitted by very brief contact or by kinds of contact that are very difficult to avoid. On the other hand, with those diseases that are conveyed almost solely by means of intermediate persons or objects, or by direct handling of the patients' persons or excreta, we should, by adopting proper measures, be able to reduce the number of infections to so low a point that the danger from these diseases would be decidedly less than from the diseases that are or appear to be frequently air-borne. We cannot, at present, isolate them all; and a perfect system of isolation for all of them can scarcely be looked for in the near future. Indeed, any system of actual isolation of even all those that are of serious consequence will remain, for a long time, at least, a practical impossibility, and with some of them it will, I trust, be found to be unnecessary, for I believe that some of them can be prevented by less rigorous though more detailed measures. I am speaking, of course, of conditions in well-organized hospitals, not of private practice. In the latter, because technical details cannot well be carried out, as a rule, and isolation often can, I believe in regular insistence upon as much isolation of all infections of consequence as one can secure.

Any plan adopted must depend upon the conditions in individual hospitals. That which I have gradually elaborated for my own period of service at the Episcopal Hospital depends upon the means available there. On the men's medical side, we have, on each of two floors, a large main ward, containing thirty-one beds; a small adjacent ward, containing seven or eight beds; and two smaller rooms, one of which will hold two or three beds, the other, four beds. These latter rooms were once used for private patients. They have recently been largely released by the managers for purposes of isolation. The quarters for the women are the same as those on one floor on the men's side, except that there is no small ward. The children occupy the upper floor on the women's side, and the arrangement on their floor is the same as on that for the women. Besides the quarters mentioned, we have heretofore used a series of unoccupied rooms on the upper floor of another building for the immediate isolation of any highly contagious cases that appear in the wards, and we now have a well-equipped isolating pavilion for such cases. On the men's side, the more acute cases are kept on the lower floor, while chronic and convalescent cases occupy the main ward on the upper floor. The side ward on the upper floor is kept for youths, who are best separated from the doubtful moral influence of the men in the ward.

Each day that I visit the wards I survey the situation of the cases in relation to one another, and determine that the arrangement of the cases is the best possible in my judgment, under the circumstances existing at that immediate time. The general plan followed is this:

When febrile cases of doubtful nature are admitted, they are put into the side ward on the men's side, into one of the side rooms in the women's quarters, until it becomes clear that they may safely go into the main ward or that they should go elsewhere. This reduces the danger from cases that would otherwise occasionally spread infections. When the wards are full, all the beds in this side ward are continuously in use, and suitable cases are moved into the main ward, while patients that are disturbing in the main ward (owing to delirium, outcries, incontinence, etc.) are, so far as possible, kept in the side ward, or, if very disturbing, they are put into one of the smaller rooms, if one is vacant.

PLACING OF INFECTIOUS CASES. Cases with recognized infections are placed as follows: Typhoid cases are put into the main ward, and cases of this disease are kept together, other patients not being put among them. Cases with acute gastro-enteric attacks, dysentery, and the like, are put into the side ward, if very ill. If not, they are sent to the convalescent ward. The facilities for caring for those that are very ill are better on the lower floor; but I attempt to keep all such cases as well separated as possible from patients that have any diseases, especially typhoid fever, that render the transmission of such infections to them more probable and more dangerous. Nurses who have charge of such patients are warned to be especially careful about their hands.

Tuberculous patients are put into the four-bed room on the upper floor, this room being regularly reserved for them. It suffices for the number that we receive. It is almost undoubtedly possible to treat tuberculosis in a general ward with practically entire safety to other patients, provided that the tuberculous patients intelligently and conscientiously follow orders; but it is so uncertain whether they will do this or not, and they are so likely not to that I quite agree with the general view that they should be isolated. I think, too, that it is almost equally important on their own accou t to keep them out of the general wards, because "colds," attacks that fall under the group that clinically is usually loosely called influenza, and similar conditions, frequently turn up in the general wards, and tuberculous patients are very subject to these and are frequently seriously damaged by them.

Tonsillitis is rarely admitted. If it is for some special reason, or if it develops in the hospital, the patient is isolated in a separate room and a special nurse is put in charge of the case, both because it is often so difficult to exclude the possibility of diphtheria—and it is important to get this disease out of the ward, even before getting a definite report from the culture—and also because it is not just to expose other nearby patients to tonsillitis, which may be transmitted through brief exposure, and apparently through the atmosphere. If there is no room for actual isolation near the ward, the case, if at all seriously suspicious, is sent to the separate isolating building. If it is only slightly suspicious, the patient is treated in a corner of the L of the corridor, where he can be well separated from the others. If the ward is not very full, and the rooms are occupied, the case may be treated in a corner of the ward well separated from the other beds, a screen being placed around the bed of the tonsillitis patient to keep walking patients away from him. It is probable that the infection is transmitted atmospherically for only a short distance. Therefore, if other patients are kept at a considerable distance and strict care is observed regarding cleanliness of the hands, etc., it is probable that such patients may, with entire safety, be kept in the ward.

DANGER FROM PNEUMONIA. Pneumonia has especially engaged my attention in regard to the question of isolation. My feeling is definitely that this disease needs to be isolated quite as much as any disease that is admitted to general hospitals, and, beyond all else, patients with pneumonia should be kept away from those who have typhoid fever and other very depressing diseases. I have reported a little epidemic that occurred in my wards in 1903, the cause of which seemed to be clearly that a fatal case in the side ward that was very heavily infected had infected the surrounding area of the ward. The patient had been very delirious and had spat in all directions. The patients who became infected had been near him, but when the infection developed in them most of them had been moved to various parts of the main ward; consequently, it required some investigation to determine the source of the several cases of pneumonia that I found appearing in my ward in this instance. When determined, the side ward was formalized, and the trouble was entirely overcome.

It is perfectly well known that definite ward epidemics of pneumonia occasionally occur. Much of the testimony regarding ward and other epidemics I referred to some years ago[3] and need not repeat. Every clinician of experience has also repeatedly seen individual cases develop in hospital wards, especially in those who are near patients with pneumonia. I have, unfortunately, no definite records of the number of such isolated occurrences that I saw previous to 1903, but I can, from mere memory alone, recall three instances before that time in which typhoid patients developed lobar pneumonia when pneumonia cases were near them, and I can also remember a case of diabetes and one of recent mild apoplexy in which the same thing occurred when the patients were in beds next to pneumonia cases. All these five cases were fatal. Since the occurrence of the ward epidemic that I observed in 1903 I have been using the precautions in regard to isolation or segregation that I shall describe, and—whether as a consequence of this or not, I cannot state—I have seen but two other cases of lobar pneumonia develop in patients in my wards, and one of these occurred after a patient with unrecognized pneumonia had, in my absence, been placed in a bed between two typhoid patients. I have, therefore, no important recent observations of my own that are pertinent to add to these earlier cases. I think, however, some evidence of occasional transmission of pneumonia could be found in any large hospital if actually looked for. In examining the records of the typhoid cases I found casually that in the last week of April, 1904, when I was not on duty in the men's ward, there occurred four fatal cases of lobar pneumonia in typhoid patients within a week, in a limited area of this ward, after pneumonia cases had been placed near or among them. One of my colleagues has also informed me that since that time he has had six ward cases of lobar pneumonia within two weeks, in the same circumstances. I have knowledge, also, of similar occurrences within the last four years in several other hospitals in Philadelphia. In one of these, the pneumonia infections were so numerous and persistent that the ward was closed and formalized. In another (the Philadelphia Hospital), there were so many infections as to lead Dr. Martin and Dr. Biggs to set aside a ward for pneumonia cases. Most of the infections mentioned were in typhoid patients, who are extremely non-resistant to this infection.

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[3] Therapeutic Gazette, 1904

Such infections not infrequently occur in individual cases, and I think that there can be little doubt that ward infections with pneumonia are, all told, as frequent as are ward infections with typhoid fever. They are certainly much more dangerous, for a large proportion of them are fatal, especially when they occur in patients already seriously ill—as, for instance, in typhoid patients. I feel, therefore, that pneumonia, first of all the acute diseases received in general hospitals, should be isolated in some degree. The literature on ward epidemics shows that most of the cases have developed in patients who were near those who had pneumonia. If the patient is tractable, therefore, so that the sputum can be properly cared for, it is very probable that the danger becomes extremely slight if he is kept at a distance from other patients, even though he be still in the same ward, provided that precautions are also taken against transferring the organisms to others by means of the hands of the attendants, the drinking vessels, etc., and that extreme cleanliness is used in regard to the ward floor, etc. Safety in cleansing the ward will probably be greatly furthered through the introduction of the vaccuum system of cleaning.

My custom, then, is to place pneumonia cases in one of the rooms near my wards, so long as I have space for all of them there. If I have at one time too many cases of pneumonia, and of other kinds that need isolating, to permit of this with all the pneumonias, I put the mildest and most tractable of the latter in the ward, separating them as far as possible from other patients, especially from those with typhoid fever or other diseases that greatly reduce resistance, and, if there are any vacant beds, placing these between the pneumonia patients and the nearest other patient. I also screen the beds of the pneumonia patients because this probably helps to prevent the spread of infection, and it keeps other patients away from them. It also has a good moral effect upon the ward staff, as a reminder of the need of care. Delirious or intractable pneumonia cases are always kept out of the wards.

ISOLATION OR SEGREGATION OF VARIOUS OTHER COMMON INFECTIONS. I segregate in the ward, or, if I have space, isolate, cases that develop so-called "influenzal" attacks, whatever bacteria appear to be causative. When diagnosticated as such, they are not ordinarily admitted when such conditions are epidemic, if we can humanely avoid it, because it would be impossible to isolate large numbers. If they must be admitted, they are isolated, if possible, or, at any rate, segregated. So far as possible, I also separate from others in the ward all patients with ordinary "colds." Whenever new cases with any infectious disease are admitted to the ward, I attempt to see myself that the position in which they are placed in the ward or in isolation is the most satisfactory possible in the circumstances existing at that time. I have already noted what I do with skin infections.

I believe that such a system is, under our present working conditions, likely to accomplish more good than simply directing our attention to one or two important diseases and permitting the rest to be mixed up together. I have not followed the recent trend, and attempted to isolate typhoid fever, because I believe that, with the precautions in the care of this disease that I have described, it is probably possible to reduce the danger of its transmission to so low a point that it is very slight, and less than that from those other diseases which I do isolate. I prefer to use my isolation space, first of all, for other diseases, particularly pneumonia. I have also had so many typhoid cases that I could not have isolated them unless the main ward, and often even more space, had been used for them alone, and this would at frequent intervals have left a large part of our space unoccupied, and would thereby have worked hardship to a large number of patients seriously in need of hospital care, who would have been excluded.

In the last half of 1907, the introduction of a supply of filtered water has marvellously reduced the number of our typhoid fever cases. Instead of from 50 to 150, there are now usually from 10 to 20 typhoid cases in the hospital at one time. I may find in future services that I can isolate these cases, and, if so, I shall hasten to do this, but I shall still give preference in isolating to diseases that are apparently capable of being conveyed through the atmosphere. The danger that children may acquire typhoid fever in a hospital ward is, however, so very considerable, and contact infection is so very hard to prevent with any children that are on their feet, that the measures I have suggested as suitable for adults would be much less effectual with them, and with them, I think, isolation should be rigidly insisted upon.

One important way in which adult patients acquire typhoid fever is, undoubtedly, through helping about the ward. While preparing this article I have seen a walking patient carry a bedpan from a typhoid case and immediately afterward start to eat his dinner without having washed his hands. This is an example of common occurrences. Orderlies, who are employed for such purposes, must take their chances, after having been duly warned, but it is not proper to permit patients to endanger themselves in such ways.

APPARENT EFFECTS OF REGULATIONS. My faith in the system of asepsis and partial or complete isolation that I have described is at least not lessened by my experience in recent years, and particularly by my service in 1907 at the Episcopal Hospital, since this paper was prepared. During this latter service I had this system, for the first time, in fairly complete order. While there were, of course, many little ways in which it was imperfectly carried out, I escaped, for the first time, almost all evidence of avoidable ward transmission.

As I have already stated, I had seen no evidence of the transmission of pneumonia infections since I instituted precautions against it, whereas during the several years before that time I had seen evidence of it each year, and in one service I had had a little epidemic. In 1907 I had a large number of cases of pneumonia for some time, but there was no evidence of ward infection with this disease, except in one case. This was the instance mentioned in which a patient with an unrecognized pneumonia had, in my absence, been put for two days among the typhoid cases. Within these same years in the same wards two of my colleagues, at a time when they were placing pneumonia cases among or in proximity to their typhoid cases, had a rapid series of cases of lobar pneumonia in their typhoid cases, and there were, in addition, a considerable number of individual cases.

As to typhoid fever, I had had, in each of the four preceding years, at least one definitely recognized case of ward infection with this disease, in spite of sufficient protection of the food. In 1907 I had no ward infection with typhoid fever. This, however, may have been partly due to the fact that I had only about two-thirds of the number of typhoid cases that I had seen, on an average, in each of the preceding four years.

For three years before, after instituting precautions against them, I had seen no evidence of the transmission of skin infections, and I saw none in 1907. In these four services there had been in the wards a number of isolated cases of virulent furunculosis and two isolated cases of the peculiar vesiculopustular infection that I had previously seen spread rapidly. None of those seen in the past four years spread at all.

In each preceding year I had seen little outbreaks of diarrhœa and sudden groupings of hemorrhage and perforation in typhoid cases; the diarrhœa developed in a considerable proportion of instances in those that had been free from it on admission, and a large proportion of the hemorrhages and perforations occurred in these latter cases. In 1907 I had an exceptional number of typhoid cases admitted with severe and persistent diarrhœa, and I saw no evidence of the transmission of this, and had no groupings of abdominal complications. Indeed, I had only one severe case and two very mild cases of hemorrhage and two perforations, one of the latter occurring unexpectedly in a convalescent. I saw during this time 116 cases of typhoid fever.

This satisfactory state of affairs may have been partly due to chance. I think, however, that it may fairly be considered to have been due in part to the system used.

PROTECTION AGAINST FLIES. There are several other points to which I would refer in closing. The danger of the transmission of diseases by insects is now so well known that screens in ward windows and doors are becoming, in well-arranged hospitals, a pretty thoroughly recognized necessity, in order to protect uninfected patients as well as the surrounding community. Even, however, in those wards that are screened one can frequently see many flies, and they, of course, get well covered with infectious material. They should be destroyed as completely and as rapidly as possible.

DIVISION OF WORK AMONG THE NURSES. Another point that is occasionally of much consequence and that needs supervision is the division of work among the nurses in the ward. I have found a number of instances in which the plan used was very bad. I have mentioned the worst instance, in which the nurse's duties included the preparation of the liquid diets and the disinfection of the soiled bedclothes and the stools. Another arrangement that, because it was less obviously dangerous, is a better illustration of the need of critical supervision of this matter was made apparent through a series of little ward epidemics of diphtheria in the main men's medical ward at the Episcopal Hospital. An investigation of this matter by the staff finally developed the fact that, owing to pressure of work, it had for some time been arranged that a nurse occupied in the out-patient department half the day should spend the other half in helping in the men's medical ward, and this nurse, it was found, was the one who had worked in the nose-and-throat dispensary. In the last outbreak of diphtheria she had evidently carried the infection, for it was learned that she had had a sore throat for a day or two before diphtheria appeared in the ward, and investigation showed her trouble to be an atypical diphtheria. Not improbably, the previous outbreaks had been due to the same cause. Of course, no scheme can be suggested for the nurses' duties that would be suitable in all hospitals. The arrangement in each ward should, however, be known by the visiting physician, and its suitability judged of by him.

MORE EMPHATIC WARNING OF NURSES. Finally, I would urge that greater attention be given to instructing the nurses regarding the very serious danger that they are in from typhoid fever, and that more detailed and constant attention be given to ensuring their use of proper precautions, for they are often exceedingly careless as regards themselves. We have had an unfortunately large number of cases of typhoid fever in nurses at the Episcopal Hospital, and I urged the adoption of some of the measures that I have described quite as much on their account as because of the patients. I think, however, that the figures I have given show that, as compared with the great number of typhoid cases that they have had to care for, and as compared with the figures elsewhere, the number of nurses that we have had sicken with this disease is really gratifyingly small.

This must, I think, be attributed to the fact that Miss Payne, who has been chief nurse during this period, has had a serious and constant sense of the importance of the matter, and has devoted much attention to it. It is, likewise, due to her responsive interest in such matters and to her intelligent direction that I have been able to put into operation the plans that I have had in mind, and I am indebted to her for many suggestions, as I am likewise to Miss Marion Smith, who has adopted many of the same regulations at the University Hospital.

The scheme that I have described may seem somewhat formidable, when viewed as a whole. The regulations do add to the work of the wards, and this cannot be avoided. It is difficult to have them used in satisfactory detail, and I have not yet been able to secure or to demand their use in entirely satisfactory form. This is, however, to be expected, especially at first. They have, in some part, been used for several years past during my services at the Episcopal Hospital, and in chief part during my last service. In considerable part, they have been used for some months past at the University Hospital. The burden that they have caused in these institutions has not been heavy.

I am fully convinced that neither these nor any other systematic regulations will be of much profit to anyone unless the visiting physician takes constant care to determine that the details are carried out continuously and as accurately as possible, in the manner that is best suited to the wards in which he does his work.

THE NATURE AND THE MANAGEMENT OF DIABETES MELLITUS.

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Diabetes mellitus was known to Celsus and Aretaeus in the first century A. D., and was described and named by Galen about 200 A. D.; but though so long recognized its etiology is not even yet perfectly understood. Though often accompanied or perhaps caused by pathological conditions, diabetes is really a disturbance of metabolism, rather than an actual disease as we understand that term.

Diabetes mellitus and glycosuria are not interchangeable terms. The name diabetes mellitus should be restricted to such cases as have sugar in the urine which cannot be removed by any dietetic or medicinal treatment. On the other hand, glycosuria, while a symptom of diabetes mellitus, may be only an indication of functional disturbance, alimentary, nervous, etc.